FIELD GUIDE

to the
Natural History
of the
Means Woods
Nature Reserve

MIDDLEBURY, VERMONT

by Howard E. Woodin
Professor Emeritus of Biology
Middlebury College

1987

Report Sheet Regarding use of the Means Woods Nature Reserve

Date:_____ Time:_____

Leader:_____

Representing:_____

Number in Party:_____

Did you use the Program Center?_____

Principle Objective of trip:_____

_____

_____

_____

Did you find the trail easily followed?_____

Problems:_____

_____

New Species not in guide: (give CT# and trail)

Please return this sheet to **Ilsley Library**, or to the **Community House** (large yellow building by the Post Office) or the **Middlebury Elementary School office.**

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GENERAL FEATURES

D. M. MEANS MEMORIAL WOODS NATURE RESERVE

This tract of land, comprising 29.4 acres, was given to the people of Middlebury by Miss Elinor H. Means, on August 15, 1969, primarily for the purpose of environmental education. (See: "Warranty Deed Excerpts" on page 16.)

The field guide is not a list of the Latin names of plants that line the nature trails. Rather, it reflects the aim of the trustees, which has been to develop an area where we can interpret natural occurrences of plants, animals, water, rocks and soils and their interactions in the light of the ecosystem as a whole. This section gives the general features of the Reserve. The appendix describes features seen along the nature trails.

Acknowledgments

The efforts of many people have resulted in this Means Woods field guide. Joseph Widli surveyed the boundary of the Woods. In the early stages, people from a number of organizations cleared the trail. Stanley Counter maintains the trails. The field guide itself has been improved by Thomas Root's editing. Brewster Baldwin helped in mapping the trails, preparation of figures, and editing. Cindy Gorton has done most of the typing of the manuscript. To all these people, my deep appreciation. The Town of Middlebury has provided funds for preparation of the manuscript, and Middlebury College has helped in the cost of publication. The Rainbow disks and laser print-out are filed in the College Archives of Starr Library.

HOWARD E. WOODIN
Ecologist and Trustee

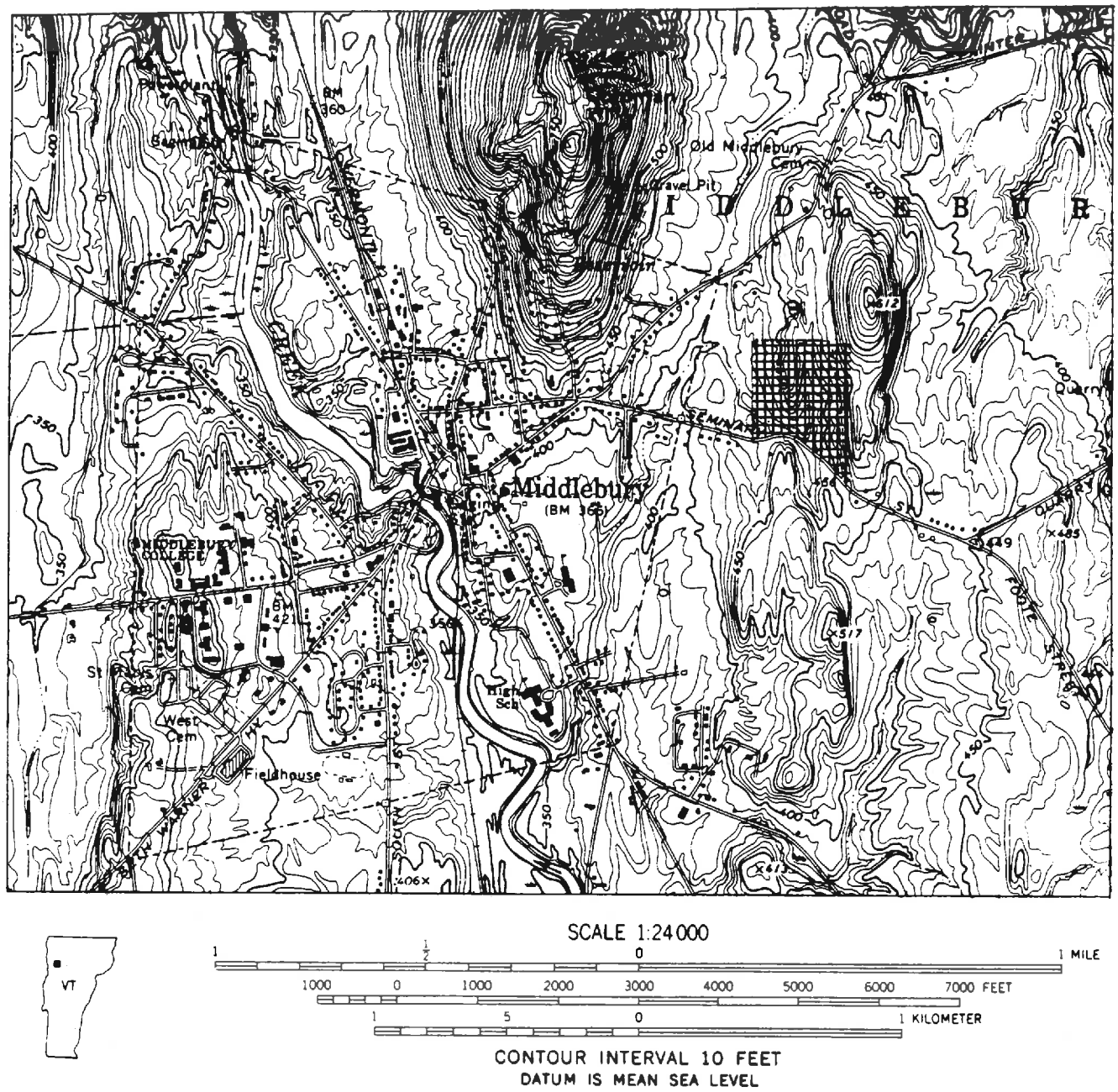

Figure 1. GENERAL LOCATION
The Means Memorial Woods Nature Reserve is indicated by the cross-hatched area on Seminary Street Extension.

NATURAL HISTORY OF MEANS WOODS

The Ecosystem

A walk through Means Woods should be viewed as a visit to an ecosystem. All the components of such a self-sustaining natural system are present. Here we find solid earth, atmosphere, water and living organisms. Energy from the sun is being used to bring together chemical elements from non-living components of the system to produce green plants. Chemical energy is passed in turn to the animals that eat the plants and each other.

At each transfer it is estimated that about 90% of the energy is lost as heat due to inefficiency, and that only 10% is left to make living biomass. It is obvious that only three or four steps or trophic levels are possible. Ultimately, the last bit of energy in this food chain is utilized by the decomposers such as fungi and bacteria. The chemical elements are released into the non-living soil to await another opportunity to enter once again the age-old food chain of producer plants, herbivores, carnivores and saprophytes. The system is deceptively simple but all life, including our own, is part of it.

Plant Succession and Climax Associations

Following the de-glaciation of the Middlebury area, the raw collections of gravel, sands and clays became populated with plants whose spores and seeds were carried by the winds from the south. The plants that were capable of living under such conditions were usually annuals and biennials and were soon superseded by woody plants. Such vegetational changes are known as succession. With continual warming of the climate, as modified by local exposures and varying soil conditions, the present mix of species became a part of our local climax forest type, which actually is a mix of trees from at least two climax forest biomes.

Man-made clearings, such as along the power line, provide open space that is quickly seeded from nearby trees. Therefore, the clearings, if not maintained, will go through a succession to white pine in 20 years. This is much more rapid than changes in response to climatic change.

Climax Forest Biomes

Biomes are vegetational units that reflect the major features of climate and are identified by similar life forms such as needle-leaved versus deciduous, broad-leaved trees. Where two biomes meet, the tree species of both mingle and form an ecotone. Most of Vermont lies just south of the great east-west band of spruces and firs (known as the coniferous forest biome) that stretches across North America north of the 50^{o} latitude line. Vermont also lies just north of the deciduous forest biome. Means Woods happens to offer the correct climatic range as modified by local altitude, soil and moisture conditions to satisfy numerous species from both of the above biomes.

Interestingly enough the deciduous forest biome has been subdivided into several climax forest types. The subdivisions were established in the Allegheny Mountains. The great deciduous forest there occupies an area with about 30 to 60 inches of rainfall and an altitude range which produces a distinct temperature variation. Due to local compass exposures and areas with soil conditions that are capable of holding different amounts of water, we have in the Means Woods comparable locales for several of the climax forest types that are prominent south of us. Small pockets are found of the following climax forest types: birch-beech-maple, maple-basswood, oak-hickory, and what used to be called the oak-chestnut before the universal demise of the American Chestnut due to blight.

The particular plant species found in the different parts of Means Woods reflect the nature of the bedrock and especially the soils.

Geology

Geologists place the oldest items on the bottom and the youngest on top, because in most cases this is the order in which the rocks and soils are found. To read the history, then, read from the bottom upward to the top! Features recorded in Means Woods are indicated in **boldface.**

Table 1. Geologic History

Glaciation and Deglaciation

years ago

10,000 - Lake Champlain replaced the Champlain Sea

12,000 - Lake Vermont drained from the Middlebury area **and erosion and soil formation began.** Meanwhile, salt water flooded into the Lake Champlain basin.

12,500 - As the last glacial lobe melted northward, it was replaced by Lake Vermont, which **deposited lake clay over most of the Middlebury area.**

15,000? - Ice melted from the mountains but a lobe remained in the Champlain lowlands. **The ice deposited bouldery glacial debris (glacial till).**

75,000 - The last ice sheet oozed southward to Long Island; it was thousands of feet thick in Vermont, because it covered Mt. Mansfield.

Bedrock Geology (no record between 350,000,000 years ago and the glaciation)

millions of years ago

350 Mountain building nearby; uplift of the Green Mountains, and **some folding and faulting of the rock layers.**

440 Mountain building to the east, and **some folding and faulting of the rock layers.**

570-440 **Deposition of shore-zone and shallow marine sediments - limestones, dolostones, quartz sandstones (quartzites).**

(older rocks are found in the Green Mountains and the Adirondacks)

Bedrock Geology

Nearly all the rocks in Means Woods are dolostone (a rock made of the mineral dolomite), which is a cousin of limestone. Dolostone consists of calcium carbonate ($CaCO_3$) and magnesium carbonate ($MgCO_3$) in equal amounts. Small percentages of iron (Fe) replace the Mg, and on weathering the iron oxidizes to give the rock a tan or brown color. In effect, the rock has rusted slightly!. Some of the dolostone has very thin (2 mm or so) layers of what was mud but has been compressed to slate. In some ledges, white masses of quartz are seen. These formed later than the dolostone.

The rock is part of the Bascom Formation, a Lower Ordovician set of beds that include limestone and quartz sandstone as well as dolostone (Cady, 1945). These are part of several thousand feet of layers that were deposited on a broad shallow marine platform that was much like the Bahama platform of today. To the west lay the continent, and to the east, perhaps where the Green Mountains are now, the platform gave way to the continental slope and rise of an ancient deep ocean.

This ancient ocean had been created when a large ancient continent split or rifted apart. The ocean gradually widened and sediments were deposited on the platform and ocean floor. Then the ocean slowly closed. Then the ancient North American continent collided with a volcanic arc, whose remnants are in western New Hampshire. This collision caused crumpling - folding and faulting - of the platform sediments. The little folds, which are parts of large folds, are seen on the Red Trail north of trail marker RCT #65, and on the White Trail at the ridge top near CT #38 and also just south of CT #51.

In the several million years since then, the Middlebury area was eroded, and thousands of feet of rock layers were removed.

Deposits From Glaciation

Most recently, in the last tens of thousands of years, Wisconsin-age glaciers moved southward and eroded soil and some rock from the region. The last glacier melted back and uncovered the Middlebury area about 12,500 years ago, leaving its load of debris in the valley as had all its predecessors. The Farmington soil developed on this debris.

Since the glacier itself blocked water flow to the north and the land to the south was still depressed by the tremendous weight of the recent ice, the Hudson River valley became the water outlet. The depression, with ice to the north and an outlet to the south, was filled with "Lake Vermont". It was much deeper and larger than the present Lake Champlain. Shoreline features are about 550 feet above sea level around Middlebury. Chipman Hill, Snake Mountain, and Mt. Philo stood as islands in this lake that extended from the Green Mountains to the Adirondacks.

From the top of the Middlebury College Science Center one can look east and see the Green Mountains and on their western flank the waterline of the surface of old Lake Vermont, marked by the gravel deposits along Route 116. The glacial debris was sorted easily. The heavier the piece of debris the more quickly it dropped to the lake bed. The fine silt was carried the farthest into the center of the lake, forming the Vergennes clay.

When the lobe had melted north to the St. Lawrence lowland, the lake drained north and east into the ocean. A bit later, waters from the melting continental ice sheets caused the sea level to rise, and sea water flooded up the St. Lawrence valley and even into the area where Lake Champlain is now. Deposits of this Champlain Sea are found about 100 feet above Lake Champlain; the 12-foot whale skeleton in the University of Vermont geology

museum was found in Charlotte, 25 miles north of Means Woods. The Champlain Sea, however, never was high enough to deposit sediment in the Middlebury area.

With the weight of the ice gone the land began to rise, cutting off the salt-water inflow. Another cold period and another glacier blocked the St. Lawrence outlet until the water freshened to become "Lake Vermont #2". When the next warm period brought another glacial melt the salty ocean again entered the depression forming Champlain Sea #2. All during this time, the eroded mountain debris continually sorted itself in each new body of water. At last however, about 10,000 years ago, the Hudson Valley rose enough so that the water flowed north through the Richelieu Valley once more and, with the salt washed out we finally got our present Lake Champlain (Johnson, 1980).

Soils

When Lake Vermont drained from the Middlebury area, the glacial debris that had washed into the water had an opportunity to become our present soils now used as forests and farm lands. The soil survey for Addison County (Griggs, 1971) gives information on soils in Means Woods.

The finest, smallest particles in the center of the great lake beds thus formed the gentle, flat fields of rich silts and clays that are very fertile to this day. These soils formed directly from the water - deposited material in the central portion of the valley. In Means Woods they are represented by the Vergennes - Covington Association. It is characterized as having gentle to moderate slopes and being rather poorly drained, clayey soils. It is normally found on the old, broad lake plains and terraces.

From the point of view of development time, the Farmington and Nellis soil series have been in place for 10-12 thousand years and have used only glacial debris during their formation. The Vergennes and Covington series are, however, derived from materials brought into Lake Vermont and the Champlain Sea by streams from the surrounding highlands and deposited, sorted as to size and weight, on top of glacial debris and are, therefore, much younger.

Table 2. Soil Characteristics

Soils That Formed In Glacial Till

Farmington - Nellis Association
Permeability = 0.63 - 2.0"/hr.
0 - 20% Rock Fraction greater/3" diameter

Farmington extremely rocky silt loam (Brown Forest Soil Type)	(5-20% slopes)
Farmington extremely rocky silt loam (Brown Forest Soil Type)	(20-50% slopes)
Nellis stony loam	(3-8% slopes)

Soils That Formed In Water-Deposited Material

Vergennes-Covington Association
Permeability <0.20"/hr.
0.0% Rock Fraction greater/3" Diameter

Covington and Panton silty clays (Low-Humic Gley Soil Type)	
Vergennes clay (Gray-Brown Podsol Soil Type)	(2-6% slopes)
Vergennes clay (Gray-Brown Podsol Soil Type)	(6-12% slopes)

All these soils formed from calcareous parent material and therefore they have medium acidity; the acidity decreases with depth.

Table 3. Typical Soil Profiles
(modified from Griggs, 1971)

Soil horizons are recognizably different layers of soil lying parallel to the surface at varying depths. In forests, there is an **O** horizon of litter and humus. The **A** horizon is the zone of leaching, the **B** horizon is the zone of accumulation, and the **C** horizon is mostly parent material.

Farmington Series (in woodland in town of Weybridge, about 2.5 miles northwest of Middlebury village) an extremely rocky, silt loam formed in glacial till over calcareous dolostone.

Horizons		
O1	1/2- 2"	litter
O2	1/2- 0"	decomposed litter
A 1	0- 3"	dark brown silt loam; abundant tree roots; 5-50% gravel, cobblestones; slightly acid.
B 1	3-11"	brown silt loam; abundant tree roots; 5% gravel, cobblestones; slightly acid.
B 2	11-13"	brown silt loam; abundant roots.
C	13"	light gray limestone - effervesces violently w/cold dilute hydrochloric acid (the dolostone in Means Woods effervesces slowly).

Vergennes Series (in woodland in Town of Middlebury about 1.1 mile southwest of the Junctions of Routes 7 and 125). Formed in calcareous, lacustrine material. The "moderately shallow variant" is less than 4 feet thick.

Horizons		
		no horizons of litter are recorded.
A 1	0- 3"	very dark, grayish brown clay; moderate, medium granular structure; abundant roots; medium acid.
A 2	3- 5"	brown clay; abundant roots; slightly acid.
B 1	5-13"	dark grayish-brown clay; abundant roots; slightly acid.
B 2	13-26"	dark grayish-brown clay; plentiful roots; neutral-moderately alkaline.
C	26"+	bedrock - quartzite or limestone.

Table 4. Limitations of the Means Woods Soils for Recreational Paths and Trails (Griggs, 1971

Covington	:	Severe: Wet; clayey surface layer
Farmington (5-20% slopes)	:	Moderate: Bedrock outcrop
Farmington (20-50% slopes)	:	Very Severe: Very steep slopes
Nellis	:	Slight
Vergennes (2-12% slopes)	:	Severe: Moderate slopes; slippery and sticky when wet

Table 5. Drainage Capabilities of Means Woods Soils

Covington	-	poorly drained
Farmington	-	somewhat excessively drained
Nellis	-	well drained
Vergennes	-	moderately drained

Climate of Means Memorial Woods (Griggs, 1971)

Most of the original data here were collected for the U.S.D.A. by the late Judge Stuart Witherell of Cornwall, Vt.

Temperature

Average Yearly Temperature (Fahrenheit)	46.3°
Average Length Of Frost-Free Season	145 days
Average Date Last Spring Freeze	10 May
Average Date First Full Freeze	1 October

Precipitation

Average Precipitation (with melted snow)	35"
Average Yearly Snowfall	61.7"
Average Days/Year With Over 1" Snow On Ground	86 days
Average Maximum Snow Depth Occurs	16 Feb.

PLANTS AND ANIMALS OF MEANS WOODS RESERVE

The plants listed here represent only those collected near the trails. There are probably at least twice thic number elsewhere in the Reserve.

Most of the animals listed here have been actually seen, or their homes, tracks or stored food supplies have been identified in the Means Woods Reserve. Others are so common it is certain they exist in this area or need so much room for meeting all their needs they pass through as itinerants. Still others are completely or mostly nocturnal and have only been identified by road-kills in the immediate vicinity. Frogs and owls have been identified by their evening calls.

Plants

Ash, white	*Fraxinus americana*
Aspen, trembling	*Populus tremuloides*
Baneberry, red	*Actaea rubra*
Baneberry, white	*Actaea pachypoda*
Barberry, common	*Berberis vulgaris*
Basswood, American	*Tilia americana*
Birch, white or paper	*Betula papyrifera*
Birch, yellow	*Betula lutea*
Bittersweet, climbing	*Calastrus scandens*
Buckthorn, common	*Rhamnus cathartica*
Bugle	*Ajuga genevensis*
Buttercup	*Racunculus*
Butternut	*Juglans cinerea*
Cedar, red	*Juniperus virginiana*
Cherry, black	*Prunus serotina*
Dogwood, alternate leaved	*Cornus alternifolia*
Dogwood, gray	*Cornus racemosa*
Dogwood, red osier	*Cornus stolonifera*
Elm, American	*Ulmus americana*
Fern, rockcap	*Polypodium virginianum*
Fern, sensitive	*Onoclea sensibilis*
Fern, small spleenwort	*Asplenium platyneuron*
Forget-me-not, true	*Mysotis scorpioides*
Hemlock, eastern	*Tsuga canadensis*
Hickory, shagbark	*Carya ovata*
Honeysuckle, climbing	*Lonicera dioica*
Hornbeam, Hardhack	*Ostrya virginiana*

Horsetail	*Equisetum littorale*
Lily, trout Adders tongue	*Erythronium americanum*
Maple, sugar hard	*Acer saccharum*
Marigold, marsh	*Caltha palustris*
Parsnip	*Pastinaca sativa*
Parsnip, cow	*Heracleum lanatum*
Pine, white	*Pinus strobus*
Pine, scotch	*Pinus sylvestris*
Polygals, fringed	*Polygala paucifolia*
Poison-ivy	*Rhus toxicodendron*
Raspberry, purple flowering	*Rubus odoratus*
Rush, club	*Scirpus* spp.
Valerian	*Valeriana officianalis*
Viburnum, maple leaved	*Vibernum acerifolium*
Wild lily-of-the-valley	*Maianthumum canadense*
Woodfern, marginal	*Dryopteris marginalis*

Fungi and Insects

Ant, mound (all black)	*Formica exsecoides*
Ant, mound (red with black abdomen)	*F. truncicola integra*
Ant, carpenter	*Herculeanus pennsylvanicus*
Beetle, elm bark #1	*Scolytus multistriatus*
Beetle, elm bark #2	*Hylurgopinus rufipes*
Fly, black	*Prosimulium hirtipes*
Fly, deer	*Tabanus spp.*
Fly, no-see-ums	*Culicoides spp.*
Fungus, chestnut blight	*Endothia parasitica*
Fungus, dutch elm disease	*Ceratocystis ulmi*
Mosquito, common	*Culex pipiens*
White pine weevil	*Pissodes strobi*

Amphibians

Frog, green	*Rana clamitans melanota*
Frog, northern leopard	*Rana pipiens pipiens*
Frog, spring peeper	*Hyla crucifer*
Frog, wood	*Rana sylvatica*
Newt, red-spotted	*Notopthalmus viridescens*
Salamander, blue-spotted	*Ambystoma laterale*
Salamander, northern dusky	*Desmognathus fuscus*
Salamander, northern 2-lined	*Eurycea bislineata*
Salamander, red-backed	*Plethodon cinereus*
Toad, American	*Bufo americanus*
Treefrog, gray	*Hyla versicolor*

Reptiles

Snake, eastern garter	*Thamnophis sirtalis sirtalis*
Snake, eastern milk	*Lampropeltis doliata triangulum*
Snake, northern ringneck	*Plethodon cinereus cinereus*
Turtle, wood	*Clemmys insculpta*

Birds

This is obviously a partial list. Nevertheless they are species (except for the owls) that have been seen or heard repeatedly during the field work for this Guide. Some are registered because of nests or obvious feeding activities. This list can easily be expanded by visitors via the report sheet.

Cardinal, northern	*Cardinalis cardinalis*
Chickadee, black-capped	*Parus atricapillus*
Crow, American	*Corvus brachyrhynchos*
Dove, mourning	*Zenaida macroura*
Grouse, ruffed	*Bonasa umbellus*
Nuthatch, red breasted	*Sitta pusilla*
Nuthatch, white breasted	*Sitta canadensis*
Owl, great horned	*Bubo virginianus*
Owl, screech	*Otus asio*
Sparrow, chipping	*Spizella passerina*
Sparrow, house	*Passer domesticus*
Sparrow, song	*Melospiza melodia*
Woodpecker, downy	*Picoides pubescens*
Woodpecker, hairy	*Picoides villosus*
Woodpecker, pileated	*Dryocopus pileatus*

Mammals

Bat, big brown	*Eptesicus fuscus*
Bat, little brown	*Myotis lucifugus*
Bat, red	*Lasiurus borealis*
Chipmunk, eastern	*Tamias striatus*
Cottontail, eastern	*Sylvilagus floridanus*
Coyote	*Canis latrans*
Deer, white tail	*Odocoileus virginianum*
Fox, red	*Vulpes fulva*
Hare, varying	*Lepus americanus*

Mouse, Canadian deer	--------	Peromyscus maniculatus
Mouse, deer	---------	Peromyscus leucopus
Mouse, meadow	---------	Microtus pennsylvanicus
Mouse, pine	---------	Pitymys pinetorum
Mouse, red back	---------	Cleithrionomys gapperi
Muskrat	---------	Ondatra zibethica
Oppossum	---------	Didelphis virginiana
Porcupine	---------	Erithizon dorsatum
Raccoon, eastern	---------	Procyon lotor
Shrew, common	---------	Sorex cinerus
Shrew, short-tail	---------	Blarina brevicauda
Skunk, eastern	---------	Mephitis mephitis
Squirrel, eastern gray	------	Sciurus carolinensis
Squirrel, flying	---------	Glycomys volans
Squirrel, red	---------	Tamiasciurus hudsonicus
Weasel, eastern	---------	Mustela frenata
Woodchuck	---------	Marmota monax

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or more queen ants. There are several more of these colonies across the road in the Battell Reserve. We can probably expect a new colony to appear near this one in the next year or so. These ants are black all over but on the Red Trail you will see a different species of mound-building ant with a rust-red head and thorax with a blackish-brown abdomen. Note that the grass around the edge of the nest is bent over by the weight of newly excavated material. Note also that the grass around the mound is a darker green. This is probably because these ants have brought to the surface subsoil rich in nitrates which have leached from the top layer of soil. Please do not disturb the nest by probing with sticks. The ants need the time they would use repairing the nest to bring food to their young.

CT #5 West of the trail are a number of white pines about 2 feet in diameter. Some have the 3 marks from former strands of barbed wire. Note the "Canada mayflowers", also known as "wild lily of the valley". Another very common woods plant, it's only 3-6 inches high, and it forms loose mats of hundreds of separate plants. Usually it has only 2 all-green leaves with heart-shaped leaf bases with many, tiny, white flowers on a central stalk in the spring. In the late summer white berries form turning later pale red and are eaten quickly by small animals.

CT #6

CT #7

CT #8 Here the trail splits. If you wish to visit the Environmental Program Center before proceeding on the trail you should turn abruptly left here. The Center is about 75 feet down the hill. The main trail continues north directly beneath the power line. We have an arrangement with the Central Vermont Public Service Company that they will cut the brush under the line and not spray it. Therefore, this gives us the unusual opportunity to compare a deep-woods

habitat with an open-sun habitat. A completely different group of plants and animals live here. We are fortunate to have this feature within our Reserve. Note especially the large number of young white pines here and the abundance of other species.

CT #9 Note here (and elsewhere along the trail) the small (4-5 ft. tall) saplings of the shagbark hickory. The pinnately compound leaves are composed of 5 leaflets much like the white ash (1 terminal and 4 lateral leaflets). Look for the axillary (="ARMPIT") bud at the base of the leaf. <u>All leaves</u> have such a bud. Thus you can tell <u>leaves</u> from <u>leaflets</u>. White ash has <u>opposite</u> leaves but hickory trees have <u>alternate</u> buds and leaves. There is no large hickory tree near here to drop the nuts (seeds). They probably have been carried from some distance away and buried (planted) by squirrels.

CT #10 Watch out for the two woodchuck holes near here. (These holes tend to change position from year to year for some reason). The presence of woodchuck holes is essential for building populations of several animals. These holes will probably later be inhabited from time to time by the cottontail rabbit, which cannot dig its own burrow. Skunks often take over and foxes have been known to enlarge those they feel suitable.

The tops of the surrounding mature pines (all about 1 foot in diameter) have been broken out by high winds. Trees in forests are seldom blown completely down due to protection by the surrounding forest. From here on to CT #11 note the grove of 1" diameter pines. Count down from the terminal branch the number of "whorls" of side branches. Add 2 to that number and you should have the year they started from seedlings. Most likely when the tops of the larger pines were broken out, more light reached the forest floor allowing the seedlings to develop. White pine

seeds develop easily in open pasture. Recall the large number under the power line, for instance. Also, note more Canada mayflowers here.

CT #11 You should note here the straight, tall "bole" or trunk of the various species of forest-grown trees. This is a function of shading which allows the growth hormones in the tip of the tree to increase cell division and cell elongation. Side branches are also killed off by insufficient light. Open-grown trees are shorter and retain their side branches. Note also the understory of sugar maple trees. Some of these shade-tolerant maples will eventually take over as the climax species. Due to root competition, only a very small percentage of these seedlings will survive to be as large as their parent.

CT #12 Poison ivy may be found in several places along the trail. The shiny, 3 leaflet-compound leaves are to be learned quickly. This plant causes a severe skin irritation in most people. On hot days the oily secretion evaporates and some people are so sensitive to this plant they get an irritation simply by being close to it.

CT #13 After crossing the spring-fed brook, which dries up in summer, the trail turns right and heads east up the hill for some distance. Before you climb, notice the completely different type of plant community that grows on the bottomland. This area is a small sample of the Vergennes rocky clay soil which is only moderately-well drained, as compared to the excessively well drained Farmington soils over the higher land. The "brook" you saw will re-appear later on where you cross the first bridge. Here you may see the small (2 inch) reddish-orange "red eft", the immature stage of the red-spotted newt. It is often mistaken for a similar "salamander". This is the land stage of the red-spotted newt found in nearly all our local ponds and lakes.

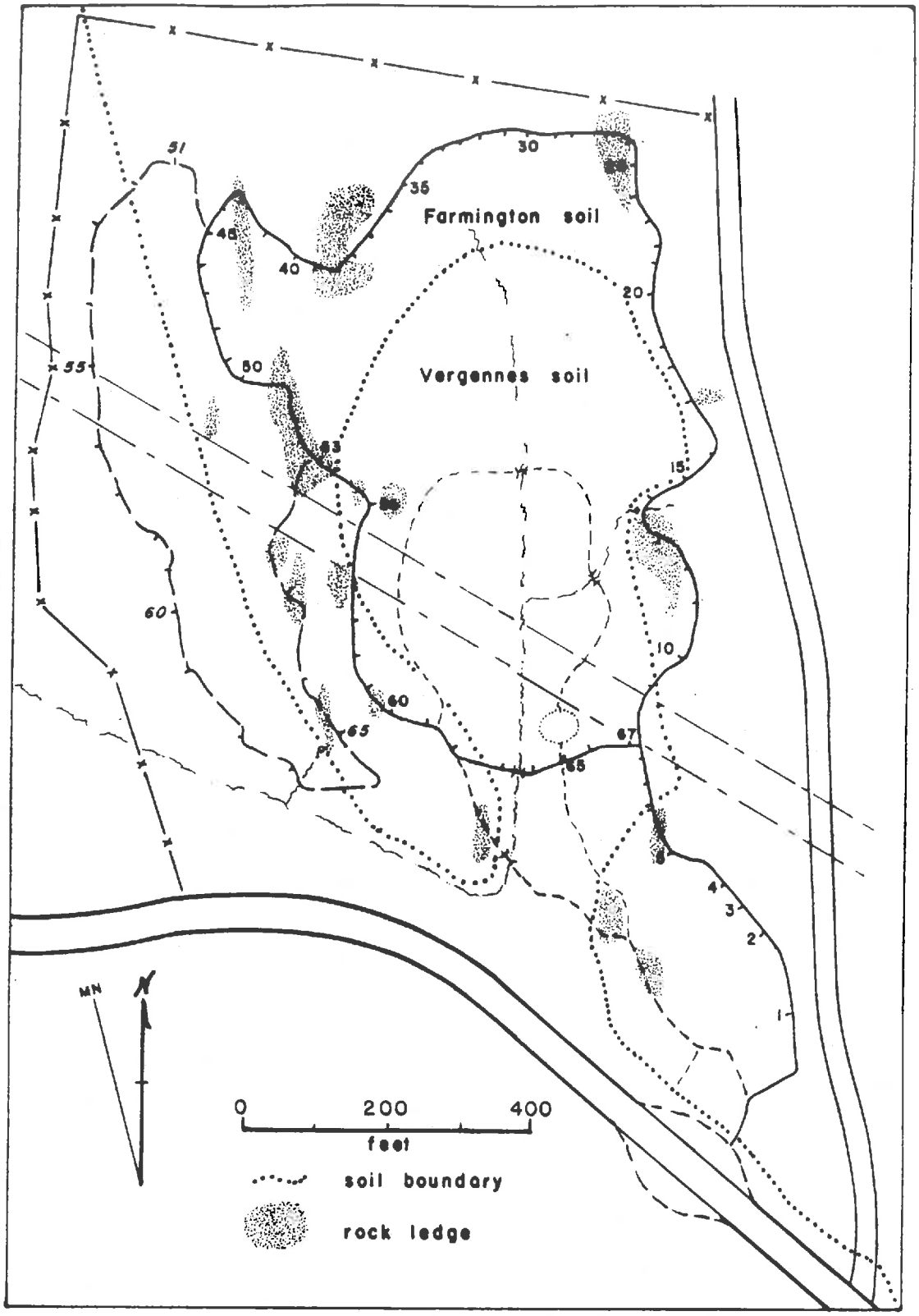

Figure 3. LEDGES AND SOILS OF MEANS WOODS
Soil boundaries are modified from Griggs (1971).
Rock ledges are of the Bascom Formation, a dolostone.

CT #14 This marker is on a large white ash. Look up and see the opposite, pinnately compound leaves of the ash compared to the alternate, pinnately compound leaves of the hickory. Note especially the finely-furrowed bark which is so distinctive that checking leaves is quite unnecessary (but keep on doing it anyway). (At this point you have already walked 1,000 feet of trail). Keep your eyes open for dying American elms all along the trail. Very often white-tail deer tracks are seen in the trail mud along here. Also note the ledges that are beginning to show here. They are made up of some slate and dolostone with nodules of quartz. Dolostone is formed from precipitated limestone. Limestone is calcite or calcium carbonate ($CaC0_3$) and if the calcium is slowly replaced by magnesium, the mineral dolomite is produced ($CaMg(C0_3)_2$). (See also the section on geology at the beginning of this guide.)

CT #15 Near here is a tree full of rather box-like holes made by the pileated woodpecker. Later, other woodpeckers will enlarge these holes and nest in them. These will be followed by squirrels and eventually perhaps racoons. Before you get to (CT#16) check the left side of the trail for a small white ash - Note: 5 pinnately compound leaflets on opposite leaves.

CT #16 If you haven't found one yet, note the dying elm on the right. These are dying from "Dutch Elm Disease". The spores of this fungal blight are carried by flying beetles and can infect trees in forests as well as along our streets. The first symptoms consist of a yellowing, wilting and later browning of leaves on individual branches which eventually die. A check under a stripped-off piece of bark reveals brown streaks on the surface of the sapwood. This is the body of a fungal disease that is spread by the elm bark beetle carrying the fungal spores. The beetle actually only wants to lay eggs in elm trees but the fungus spores are left behind as well. The spores germinate and the

resulting fungal strands fill the Xylem vessels carrying water to the leaves. The tree then literally dies of "thirst"!

CT #17 Some very well-defined ledges begin here. Again, check the geology explanation in the Natural History Section at the beginning of this guide. Here they run due north, and the strata (beds) are almost vertical.

CT #18 From (CT#18) to (CT#20) you will find several very large and very old sugar maple trees. All are interesting for one reason or another. Stop at (CT#18) and face to the right. You should see from here five of these trees.

The farthest to the right is tree # (1). It is mostly hollow for a long distance and yet it has branches bearing many leaves and produces seeds. Trees can survive with a hollow trunk as long as the outside cambium, which produces the xylem and phloem (for water and sap conduction respectively) are intact. The center of every tree is essentially "dead" and serves only as support. The tree farthest to the left (tree #5) (opposite CT #20) is completely dead. It has no bark, and with no cambium it can no longer grow. This tree was hit by lightning, but unlike the tree at (CT #1) this one did not burn.

We can estimate how many years it took to grow that tree from the sapling stage. All five of these very large trees have been "cored" with a forester's tree borer. It removes a core about 1/8 inch in diameter and about 12 inches long. If you start at the inside of the cambium and count the rings of annual xylem growth in the core, it is easy to determine how many years it took to grow those 12 inches! A special tape measure is run around the tree, breast high, to determine the "<u>average</u>" diameter (since no tree is exactly round). From this we determine the average radius containing all the annual rings until the present.

The results are as follows from tree #1 (farthest to the right, the "den" tree) to tree #5 (farthest to the left, the "lightning-struck" tree). Remember that <u>this</u> tree has actually been <u>dead</u> for an unknown number of years thus adding to its estimated age.

Tree # :	1	2	3	4	5	
Ave. diam.:	35	29	29.5	31.5	37	inches
Prob. Age :	197	149	163	169	213	years
Sapling :	1789	1837	1823	1817	1773	date

What was happening in Middlebury at approximately these dates?

CT #19

CT #20 Look to the right of the large dead Maple and you will see many small pine seedlings. This tree has just died but soon will become the home of hundreds of organisms from insects to raccoons. The raft of small seedling pines will probably not live as the shade intensifies overhead.

CT #21 Fifty feet to the left is an old dead maple exhibiting many burrows. Holes made by insects are enlarged by several species of woodpeckers for nests, then by at least two species of owls and the flying, grey, or red squirrels and finally by racoons. Note here how the hardwood (trees with broad, flat leaves such as maples, hickories and ashes) succession is coming in under white pines. White pine is seldom a climax species because it cannot succeed itself. Young pines need light and only grow well in forest openings or open fields.

CT #22 Look ahead to several, very large sugar maples which have created a huge reproduction by their seeds.

CT #23 An expanse of dolostone ledges begins on the right side of the trail. Try to notice the difference in the small vegetation on the ledges compared to what you have been seeing where ledges were not showing near the surface. Plants requiring substantial amounts of "lime" to grow are found on the ledges.

CT #24 Note that the intense shade of the young sugar maple saplings prevent the growth of much if any ground cover. Most of these saplings will die due to the competition for light and nutrients in the years to come because they are too close together. Close to the right side of the trail as you start up the ledges you will have your first look at a mature shagbark hickory. Note the long, loose strips of bark, a distinctive feature and the alternate, pinnately compound leaves. Hickory nuts are a real favorite of all the rodents (squirrels, Eastern chipmunks and all species of mice etc.) as well as white tail deer and humans.

CT #25 The trail leads between two exposed dolostone ledges. The dolostone is interspersed with "lenses" of white quartz. The layers of rock tend to dip down vertically so you can see there the broken, eroded face of one stratum of rock. Under your feet is many feet of soil which rests on part of the buried top of the ledge you see to your left.

CT #26 The north boundary of the Reserve, until a few years ago was marked by an old rail fence of red cedar, chosen because the dead wood in the center of the cedar tree contains chemicals that prevent the growth of rotting fungi. Unfortunately the rails have been "removed" for decoration purposes elsewhere. The central part of the Reserve apparently served as a fenced-in pasture many years ago.

CT #27 This is another, rather old shagbark hickory. The seeds from this and other nut-bearing trees are referred to as "mast" and serve as the primary food support for numerous

rodents including several species of squirrels who, in turn, repay the tree by "planting" (burying) its seeds! Its average diameter is 2.5 feet. Thirty feet beyond this marker is a white birch which has already been vandalized with a hatchet.

CT #28 From here until CT #33 we find a different plant association. The soil is finer and is probably the Nellis stony loam because it is less well drained and deeper than the Farmington and hence produces a more moist situation. The trees are primarily maples, ash, hickory and hornbeam. They are spaced farther apart, the forest is more open and, with the slope only 3-8%, the humus from decaying leaves accumulates.

CT #29 Here and at CT #30 note more excavations by pileated woodpeckers. Notice that you are now moving into an open maple forest. About 60 feet to your right (north) is the old fence line with some wire still attached. It marks the northern boundary of the Reserve.

CT #30 You are now in about the center of this very open woods. To the south (left) note that the vegetation opens up into a swale of shrubs and small plants. Several springs and "seepage" beds here furnish the water for the spring-time streams which dry up somewhat in the summer. You will cross some bridges over the wetter places later on. The soils down through the swale to the left (south) is the Vergennes clay soil and with a slope of 6-12% drains the entire Reserve.

CT #31 This double pine lost its leader at about ten years of age and two lateral branches took over. The most likely explanation is that the white-pine weevil was the cause. The weevil invariably picks the top-most bud to burrow through, destroying it and the tree's quality for lumbering purposes.

CT #32 This is a typical hardwood grove on, what I feel is, the Nellis stony loam soil. Hickory, sugar maple, white ash and hornbeam are more abundant here than on the Farmington rocky silty loam found along the ridges in the Reserve. Presumably these trees require deeper soil for their roots and they may enjoy the higher limestone content of the Nellis.

CT #33 The trail starts slowly upward here toward another ledge. We will find another association of plants there and the Farmington soil again shows up.

CT #34

CT #35 This "calf tag 35" is on a white ash tree. Note the beautiful fine lines and furrows in the bark of this species. Look up at the leaves. They are pinnately compound with 7 leaflets each (3 leaflets on each side and 1 terminal). Recall that the young saplings of white ash had only 5 leaflets per leaf. This change from juvenile to adult stage is quite common among pinnately compound-leaved trees but confusing to the inexperienced. The leaves are opposite on the stems (branches). NOTE: Only a few of our native trees and shrubs have opposite leaves: Maples, Ashes, Dogwoods, the family CAPrifoliaceae and the Horse Chestnut. You can remember these by the phrase MAD CAP HORSE (or MAD CAP BUCK*). Compare this phrase with the underlined letters and word in the above list. The Caprifoliaceae family of plants includes the Viburnums or "arrowwoods" similar to the exotic "Snowball Bush" often planted around our homes.

* The Horse chestnut we plant on our lawns is not a native tree. It was introduced from Asia via Europe. Our several related native species, which grow in forests south of here are called Buckeyes and are very similar in appearance.

CT #36 Just ahead note the remains of a lightning-struck maple. North of the trail about 100 feet or so are some "old" maples about 2.5 foot in diameter which means they are about 150 years old. These again may represent old, property line-trees marking the same line that is visible at CT #29. It is recognized by Vermont loggers that every alternate tree belongs to the owner on the other side of the surveyed property line. This probably developed because the wire fence was strung from one tree to another along a zig-zag line.

CT #37

CT #38 Trees from this point through CT # 40 mark the top of this ledge. Here the association changes to hickory, ash, yellow birch and white pine. Bedrock is beautifully exposed so the strata and folding of the rocks can be studied.

CT #39 The top of this ledge has a different vegetation type. Note the white ash, white pine, yellow birch and black birch. It is interesting to note that another soil type is demonstrated here - the Covington clay (Cw). It only occurs on flat or very slightly sloping areas. It is very poorly drained. Roots seldom penetrate more than a foot or two.

CT #40 Here we begin a slow descent toward the west going through primarily white ash and white pine with much reproduction.

CT #41 The descent becomes more steep with maple showing very good reproduction and the ash dropping out.

CT #42 Another dolostone escarpment runs along here. Again, as a reminder, several kinds of mosses and ferns will only grow on carbonate rock such as this. The descent becomes even more steep until it finally levels off at the bottom and the trail turns left (south) through a very fine, open woods. The soil is the Farmington rocky silt loam, according to the

Soil Conservation Service, but is deep enough and capable of holding enough moisture to be called the Nellis stony loam.

CT #43 Finally the trail levels off and turns abruptly south and opens into another valley of widely spaced trees on what I feel is Nellis Stoney loam (NeB).

CT #44 Off to the right can just be seen the reddish-orange trunks of the Scotch pine through the widely spaced trees of this valley. They are on the Red Trail.

CT #45 Looking ahead and to the right-front you can now see the trunks of the Scotch pine plantation. These trees grow very rapidly and may be seen closer up by taking the Red Trail, also known as the "Exotic Plant Trail" and the "Conservation Trail". It is marked by RED CT# markers. If you have not seen the entrance to the Red Trail yet, turn around and face the way you came and look slightly left. It is wide and well travelled. If you wish to continue on the White Trail you may do so. (The Red Trail will rejoin the White Trail at White (CT # 53).) You are again on the Farmington soil type here.

CT #46

CT #47

CT #48 In this vicinity another (same one?) pileated woodpecker has again been at work on the tree-inhabiting species of insects. In mid-spring the sides of this part of the trail have a large number of small but very beautiful plants. The flowers are red-purple (in pairs) and very striking. They are the Fringed-Poly-gals or Gay wings, (Polygala paucifolia). The "paucifolia" means the leaves are scarce and small, therefore, the plant probably will not be easily identified later during the summer. At this point Scotch pines are only about 50 feet to your right.

CT #49 From CT #48 through this area is a good reproductive stand of young birch developing. To the right (west) about 60 feet, note the very distinctive bark of the Scotch pine. This species demonstrates a phenomenal growth rate.

CT #50 At the top of the ledge you are climbing out on, you should note many more hornbeam trees. They are only a few inches in diameter here, but normally grow to about 25 feet and an average diameter of about 10 inches. Note the distinctive bark which can best be described as "shreddy". The wood is terribly hard and strong. The tree in Europe was used to make oxen yokes, hence their name of "Yolk-elms" or Hornbeams! It was also used for tool handles and old fashioned sled runners. The seeds (nuts) come in late fall and are a real favorite for ruffed grouse. Note also the great quantity of 6 to 8 foot maple saplings - very good reproduction - but how many will actually survive?

CT #51 This tag is on a basswood tree which is rather scarce in these woods. Note again the peculiar, heart-shaped leaves with uneven bases. The species is almost always found on moist yet well-drained soils such as this Farmington rocky silt loam. There seems to be no reproduction around here, but looking carefully you will see several more a little farther on.

CT #52 Note a few, very tall and slender-stemmed trees to the right of the trail, with the same heart-shaped leaves with uneven bases very high on trees as found at CT #51. These are again, the linden or basswood species. Larger trees were once used by Indians to make ceremonial face masks because the soft, easily carved wood has a very fine texture.

CT #53 Look abruptly right and note the exit of the Red Trail.

CT #54 There are several very old apple trees along here. They were probably "planted" by animals and birds who carried orchard apples here to eat.

Various species of Viburnum (which have opposite leaves) belongs to a large family called the Arrowwoods are found along here. The opposite leaved dogwoods sometimes are mistaken for viburnums, but the dogwoods have leaves that are smooth on the edges and the leaf veins tend to curve toward the tip rather than going straight to the edge.

CT #55 Note the large black cherry with its characteristic checkered bark. Note also the two dark (some remain green) glands at the base of the blade on the petiole which are also characteristic of the cherries. Along the underside of the leaf find the 2 rows of light-brown hairs making it the black cherry. The fruit of this and other wild cherries are very fine wildlife food. The CT #55 tag is directly across from a very nice shagbark hickory. Note to the left the dense reproduction of white pine and to the right an area of dense maple reproduction. Most individuals of both will die.

Ahead we will again cross the power line. On the right, at the edge of the right-of-way is a waist-high, base-branching dwarf juniper. Related to the taller, erect cedars which are also seen here it produces blue berries in profusion that feed many species of birds (and are used to flavor gin!).

CT #56

CT #57 Note chipmunk holes and pine cone debris.

CT #58 Note interesting "Y-shaped" black birch.

CT #59

CT #60

CT #61 The trail forks here. The trail straight ahead is the abandoned Braille trail. It was so vandalized year after year that the Reserve had to discard it. The White Trail bears left here and leads downhill toward the bridge.

CT #62

CT #63 Here are two bridges over the same stream that is fed by springs near CT #14. Marsh marigold, several buttercup species, cow parsnips, dogwood, willows and many others should be found here. Note the horsetails (the name is so descriptive, you can't miss them). Because of a very hard mineral called silica deposited in their stems they were called (scouring rushes) by colonists and were used to scrub pots! This swale actually has several sources (springs). It is filled with numerous wetland plants and shrubs. Beneath the mass of green plants lies the Vergennes clay soil with a 6-12% slope. Between the trails and Seminary Street Extension, the Vergennes clay soil has a slope of only 2-6% and often maintains open standing water in the spring.

CT #64

CT #65 The Environmental Program Center provides a suitable place for group discussions before and after the walk.

CT #66

CT #67 Be sure to turn abruptly right as you reach the open area by the power lines along the trail and return over the same path you followed on the way in.

THE RED TRAIL

("The "Conservation Trail"; "The Exotic Plant Trail")

This trail was originally designed to demonstrate the various exotic (usually) plants (non-native) that many people plant because some portion of the plant (vegetative or reproductive) was good for wildlife. They could be used for protection, nests or food. The place was picked because much of the exotic Scotch pine plantation was within the boundaries of the donated reserve. Since the original conception, the trail now accepts plantings of any good "wildlife-supporting" species whether exotic or native. Several species (both exotic and indigenous) have been planted but very few individuals have survived. Apparently the new species did not have the ability to compete with already established native species. The Scotch pine was an exception. The seedlings were planted in, what was then, an overgrown pasture still in the pioneer stages of succession. Their superior growth rate enabled them to establish themselves until now they are the dominant species.

Reported, known species that have been tried, in what was then open land, were the following: (N = native, E = exotic)

(N) Barberry	--------- Berberis thunbergerii
(N) Cranberry tree	--------- Viburnum opulus
(N) Dogwood, red osier	--------- Cornus stolonifera
(N) Honey suckle	--------- Lonicera dioica
	--------- L. canadensis
(E) Russian olive	--------- Eleagnus hortensis

It should be noted that this trail is the easiest one to keep clear and therefore is the widest and most easily travelled. Parts of the trail, however, are very steep and utmost care should be exercised even to the point of turning back, if necessary, to its origin on the White Trail at CT #45. The first Red Tag should be CT #50, but this tag is missing. The remaining tags are present. It should be noted, however, that the red color has faded on some so badly they appear white. Do not worry - you are still on the Red Trail.

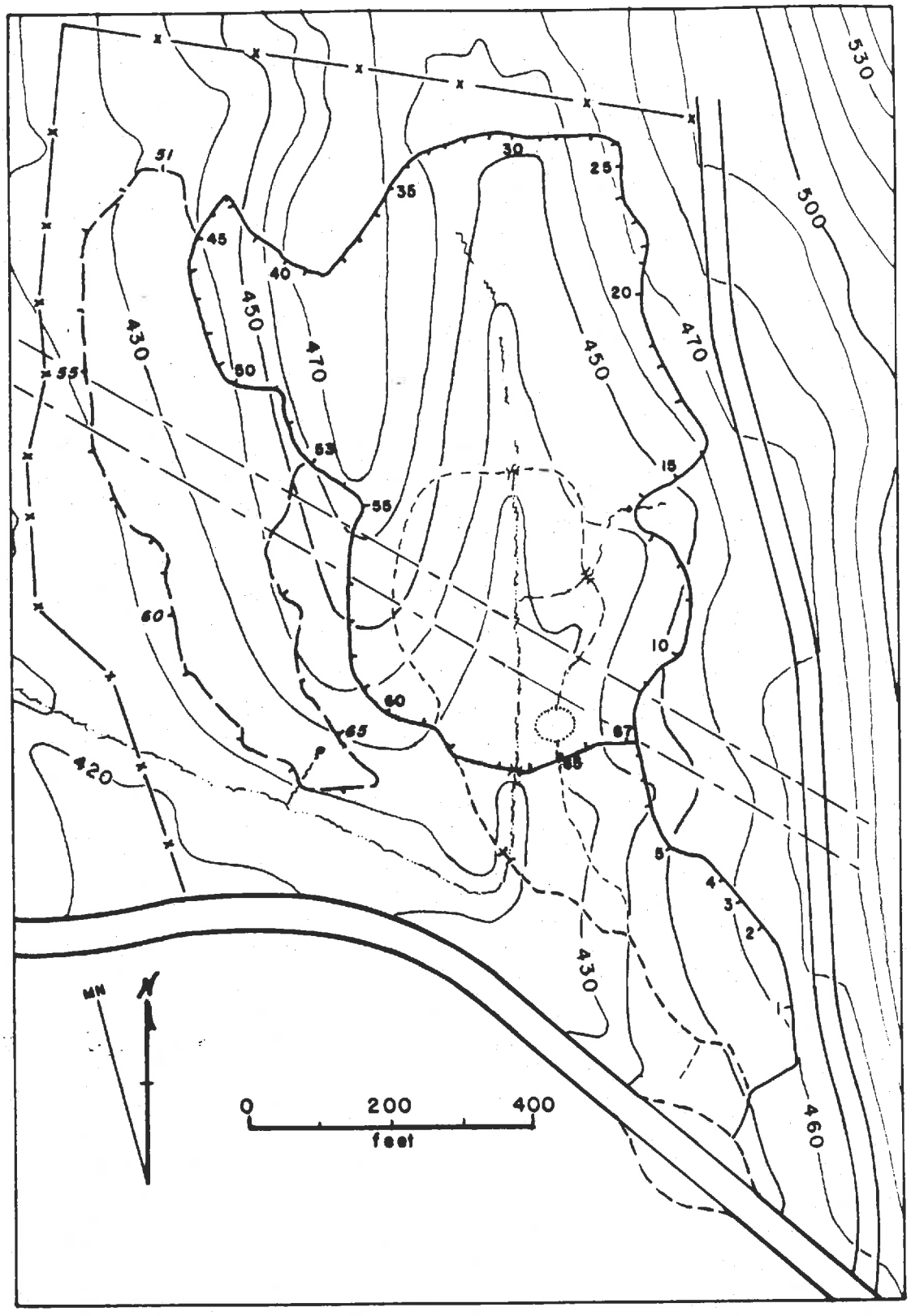

Figure 4. TOPOGRAPHY OF MEANS WOODS
Contour lines connect points of equal elevations at 10-foot intervals. Extremes are 420 feet in the southwest corner, and 490 feet in the northeast corner of the property.

RCT #50 Please note the "open nature" of this trail. This is probably on the Nellis stony loam. Obviously the soil is much deeper and more moist than the Farmington. Again, the Soil Conservation maps often do not show small areas such as this rich, little valley. It is shown on their map as the Farmington.

RCT #51 This tag occurs about 120 feet along the trail. Here are primarily hardwood species on the Nellis soil.

RCT #52 The Scotch pine plantation begins. Note the spatial regularity of the individual trees. There is a reasonable reproduction of hard maple here as well. At about this point, the Nellis soil grades into the Vergennes clay. Our records show that two species of honeysuckle were planted in openings here about 1970. It is believed that Lonicera dioica (N) is the only species left and it occurs along the trail in openings. It was spread naturally by birds carrying its berries to where they decided to eat them and then dropped them or their seeds.

RCT #53 Look up into the closest Scotch pine and notice that many of the lower limbs are dead. This could be because of extreme intolerance for light, but sometimes whole trees are infected and killed by the "Woodgate Rust". The effect of this disease is best seen as you approach the area on Seminary Street Extension, coming from town. So far, most of the diseased trees are located on neighboring property but it is expected the rust will spread.

RCT #54 Note that the stem (trunk) diameters of the Scotch pine range from 4-5" to at least 13" in one case. These differences must be caused by local soil or light conditions. All the planted seedlings were the same age and, generally, the same size. Differences in height and diameter have occurred since then. Theoretically the seedlings were set out in a rather regular pattern.

Obviously some did not survive transplanting, thus favoring their neighbors. Counting the whorls should give you their age, and approximately the year they were planted here.

RCT #55 Note carefully that any opening has usually been invaded by poison ivy, so care should be taken. Ten feet from this tag is the right of way for the power line.

RCT #56

RCT #57 The woodbine with its alternate, palmately compound leaves of 5 leaflets may be seen here as well as other spots along the trail. Also we find here for the first time the slippery elm. This seems to be a misnomer since if you rub your fingers over the top surface of the leaf toward the stem it feels like sandpaper! The leaf has the same general shape as that of our street elms but has much larger marginal teeth. There are a number of saplings you can reach along this trail. The term "slippery" describes the easy way the bark separates from the stem or trunk.

RCT #58 Watch the trail here in this rich bottom land, still the <u>Vergennes clay</u>, for small conical holes about 1"-3" deep. These have been made by the eastern skunk who was looking for grubs. You will also find these holes in your own lawns, especially in the fall when the June-bug larvae are around.

RCT #59 Along the right side of the trail, find the native honey-suckle. It should be scattered anywhere along the trail. It is a vine or short shrub and has opposite leaves along the stem with dark, small cherry-like berries near the end of the stem.

RCT #60

RCT #61

RCT #62 We are beginning to find a natural seeding-in of the white pine about the same time as the Scotch pine was planted. Continue to watch for piles of pine cone scales around the bases of the larger pines of both species. This is probably the work of chipmunks (possibly squirrels, but these tend to like larger, taller trees). Also a new shrub - the red-osier dogwood - may be found here. All dogwoods are opposite-leaved (recall MAD CAP HORSE?). Note how the veins in the leaves tend to run parallel to the smooth margins, a dogwood characteristic. This dogwood differs primarily in that the stems are reddish.

RCT #63 About 20 feet past this marker you must cross the outlet of a spring that arises in the ledge up and to your left. The spring will be seen again when the trail doubles back and leads along the top of the ledges. This spring has more water than most others in these woods. Note also you are now walking parallel to an open, very wet swale about 25 feet away. Vergennes clay soil extends from the ledge on the left out beyond the edge of trees into the swale on the right; the slope of the land is between 2-6%.

RCT #64 Here you will see a naturally-seeded white pine about the same size as the Scotch. Compare distances between whorls on both and total ages and heights. Can you draw any conclusions? Close by the tag tree you will find more examples of the slippery elm. Again try the surface of the leaf, rubbing gently toward the stem. Now you will always remember that "the elm that is rough is slippery"!

RCT #65 Note how close you are to Seminary Street Extension here. When you ride past next time try to imagine where this trail is that you are now walking on. This area is also heavy with white pine saplings. How many will grow into large trees? As you climb up along the edge of the

ledge to its highest point you will note the trail leads through a crevice in the ledge. On the right is a rock seat. Sit and look at the small folds in the rock in front of you. This is the best place to see the small features that are throughout all the bedrock ledges you've been on. Note the white nodule of quartz to the right of the down-hill outcrop.. As you leave here note the Vergennes soil at the bottom over the ledge as opposed to the Farmington soil you are now walking on. Note also the old, wild apple tree down below, planted by wild animals who have eaten apples somewhere, seeds and all!

RCT #66 Caution. Soon you must go down over a very steep ledge!

RCT #67 For about 50 feet you will walk along a small ledge through much hornbeam and maple. Again you will cross the power line. At the farther side of the clearing, on the right side of the trail you will see another ant mound. Note that this species of Formica has a red head and middle section (thorax) and a black abdomen. Do you remember the color of the ants at CT #4? Under the power line you will find young black cherry saplings. Do you remember how to recognize this species?

This is the last RCT # on this trail. As you climb up the ledge you will find directly ahead the (White CT #53). You turn right on the White Trail. Continue past the Environmental program Center to CT #8 and turn right.

*CAUTION as you follow the White Trail you should make sure you see the white (CT #) tags. You can't get lost. If you just keep going you will come out at the bulletin board again.